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A DISEASE OF CULTIVATED AGAVES DUE TO COLLETOTRICHUM.

BY GEORGE GRANT HEDGCOCK.

A number of small agave plants of the species *Agave Utahensis*, secured from its natural home, were potted during the spring of 1904, and during the earlier part of the summer. These were placed along with a large number of agaves of various species in the soil on a western exposure of one of the greenhouses of the Missouri Botanical Garden. In a short time many plants were found dying from a disease which first attacked the older leaves. A microscopical examination of a number of the diseased leaves revealed the constant presence of a fungus, apparently of the genus *Gloeosporium*; but later more careful search showed that in all the older acervuli of the fungus the characteristic setae of *Colletotrichum* were present, thus placing it under this genus.

Inoculations with conidia taken from plants placed in a moist chamber were made by wounding the leaves of healthy plants with a sterile scalpel and inserting masses of the spores in the wounds. Control plants were similarly wounded, but not infected. The inoculated plants in about two weeks became diseased in the same manner as those from which the spores were taken, and in a short time after produced characteristic acervuli of *Colletotrichum*.

Cultures were made from conidia taken from masses exuding from acervuli on the leaves of plants under bell jars, using the most careful methods with agar plates and tubes. Colonies were secured which grew to a diameter of one to two inches. A dark mycelium, with numerous knotted masses of abortive pycnidia, was obtained in a number of

cultures on various vegetable and agar media, but no mature conidia were developed. It therefore was not possible to inoculate with conidia from pure cultures. A few inoculations were made with the mycelium. Of these only one or two were successful, indicating a low vitality of the fungus when under culture.

The disease often has a striking appearance. The conidia of the fungus apparently germinate on the surface of the host and gain entrance through either the stomata or wounds. The tissues are penetrated by the mycelium in all directions, forming either a circular or elliptical spot, which at first is darker in color than the adjacent tissues, changing as the tissues die to either a brown or gray color. The adjacent tissues of the host under moist conditions turn brown and rot rapidly, the mycelium penetrating to all parts of the leaf. Under less humid conditions, however, the adjacent tissues slowly darken in color, often assuming a purple tinge. It was found in such cases that there is a death of the tissues far beyond the region penetrated by the mycelium, indicating the presence of an enzym secreted by the fungus. Bacteria are never associated with the latter type of the disease, but are often present with the former.

The acervuli are usually formed in concentric rings. This character was so constant, that, taken along with other characters, it was thought at first that we have here a new species of *Colletotrichum*. The examination of both fresh and herbarium material at the Garden, at Washington, D. C., and elsewhere has revealed the fact that such characters are variable and that the fungus is probably identical with *Colletotrichum Agaves* Cav., described as occurring on the cultivated agaves at Pavia. The following is the description of our fungus: —

Spots circular or elliptical, often becoming confluent, olive, changing to gray or brown; acervuli spherical to oblong, usually breaking through the epidermis of the host in concentric rings and ejecting orange colored

masses of conidia; setae acute to blunt, light brown, 3- to 5-septate, 110 to 170 $\mu \times 5$ to 6 μ ; conidia oblong to cylindrical, hyaline, with one to two guttules, 16 to 31 $\mu \times 5$ to 6 μ ; conidiophores erect, hyaline, usually simple, 6 to 7 μ in diameter, but very variable in length in different acervuli. No ascigerous stage was found.

Habitat: On the leaves of *Agave Americana*, *A. atrovirens*, *A. horrida*, *A. marmorata*, *A. potatorum*, *A. Utahensis*, and *A. spp.*, — often causing the death of younger plants.

The plants of the species *A. Utahensis* were the first to be diseased, and it is thought that the fungus was introduced into the greenhouse with this species. After a short time the disease spread to other species, none of which suffered so much as the original host.

A search for the fungus on agaves in the Southwestern United States has thus far failed to locate the disease, either on wild or cultivated plants. In the herbarium of the Missouri Botanical Garden, however, there are specimens named *Gloeosporium macropus* Sacc., which developed during a fortnight's detention in the collecting box of mature leaves of an undescribed large-leaved *Agave* of the *Americanæ* group collected at La Barca, Mexico, by Dr. Trelease in the summer of 1901. Some of the zonate acervuli of these specimens show the characteristic setae of *Colletotrichum*, while their other characters agree with those of *C. Agaves*.

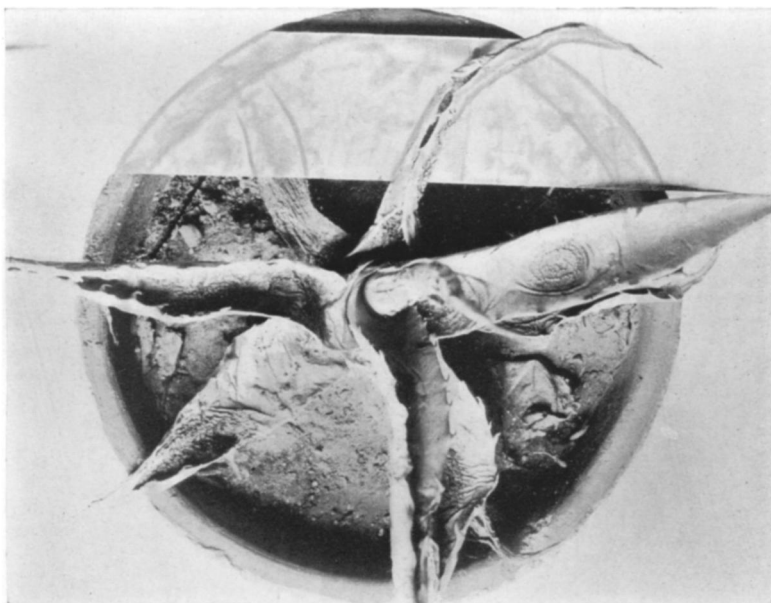
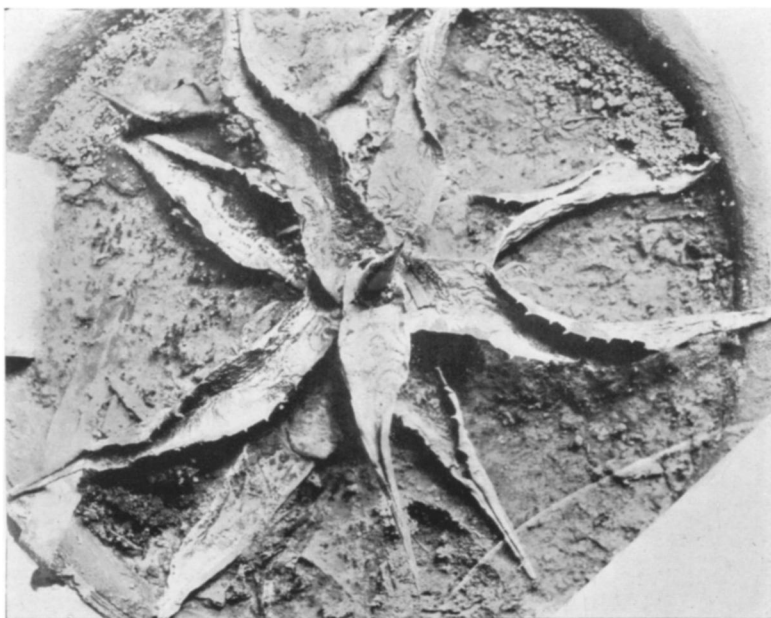
Mr. C. H. Thompson of the Garden has been quite successful in checking the spread of the disease, which is favored by moist conditions. He places all of the diseased plants in a separate locality, and removes the lower leaves as fast as they become slightly diseased. In case of older plants, the spread of the fungus is checked. Young plants often die in spite of the removal of the leaves, the fungus apparently penetrating the whole plant. Bordeaux mixture of the ordinary formulæ is beneficial in preventing the spread of the fungus to adjacent plants.

EXPLANATION OF PLATES.

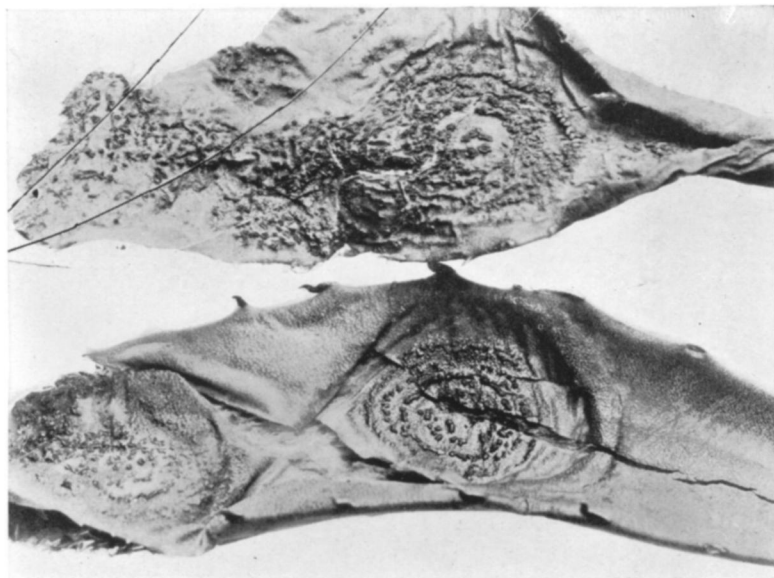
Plate 35. — 1, A young plant of *Agave Utahensis* killed by *Colletotrichum Agaves*. 2, A plant partially killed, showing the fungus with typical concentric lines of acervuli.

Plate 36. — 1, 2, Typical diseased areas with acervuli of *Colletotrichum Agaves*.

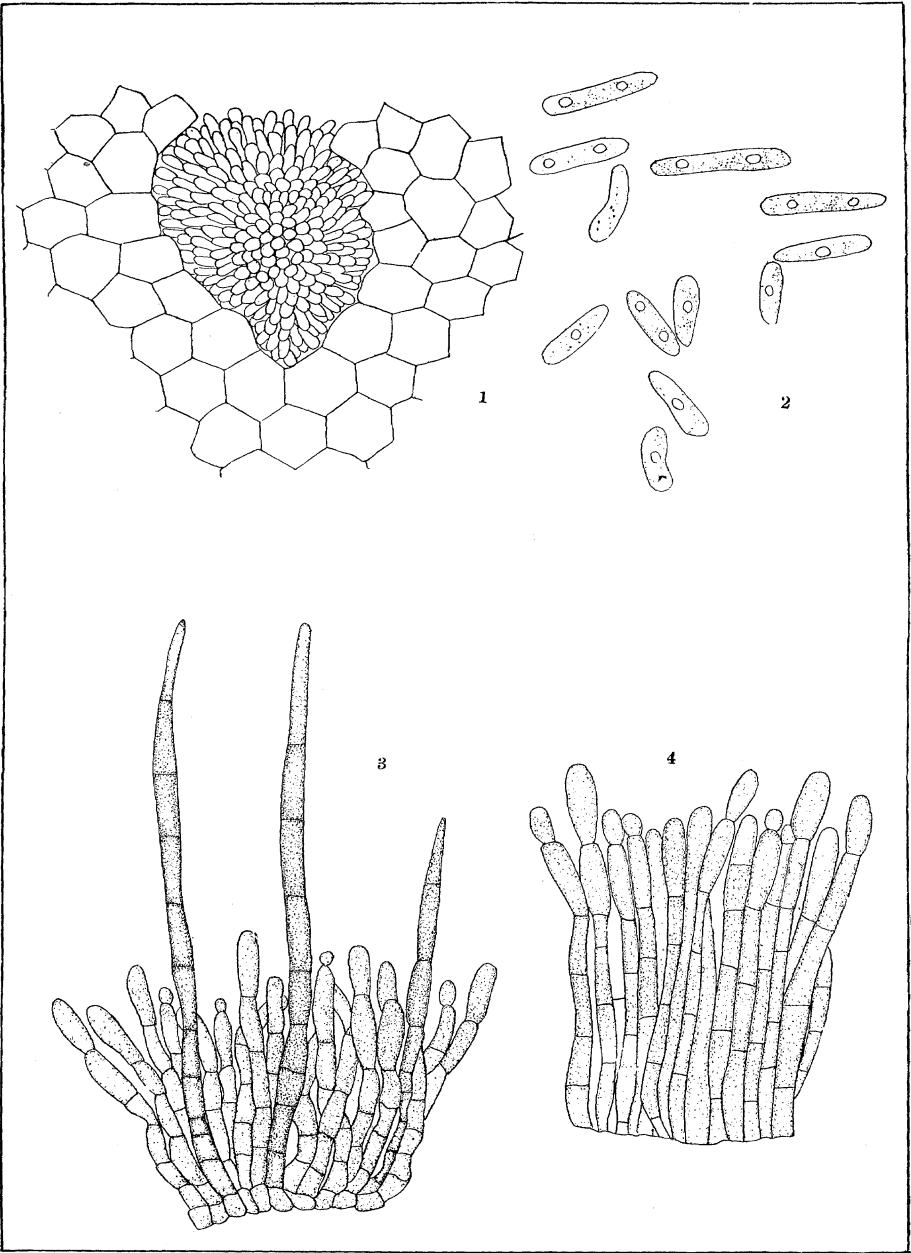
Plate 37. — 1, Acervulus of *Colletotrichum Agaves* bursting through the epidermis of the host. 2, Conidia showing guttules. 3, Setae and conidiophores bearing immature conidia. 4, Conidiophores with immature conidia.



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